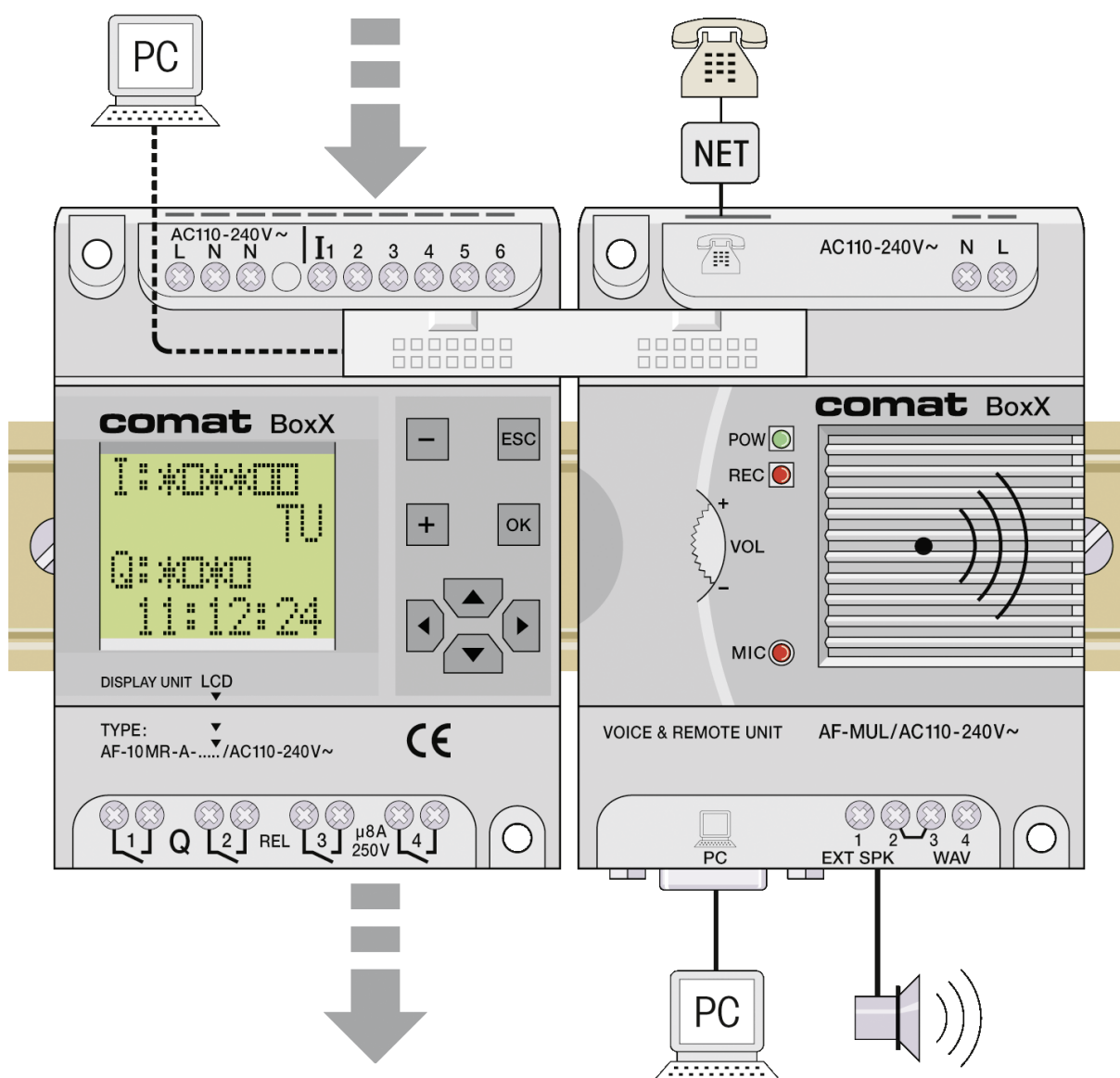


Hardware User's Manual

Including Hardware Specification and commissioning.





Preface

Thank you for choosing the Comat BoxX intelligent controller from our company. Whilst you may have a good knowledge and understanding of these products you are requested to take some time to read this manual before operation. This will allow you to utilise the more advantageous benefits of the product.

The Comat BoxX intelligent controller is being programmed by function blocks using the programming environment QuickII. The programming is simple and self-explaining so that the programmer will only need some minutes to create and run the first program.

The Comat BoxX intelligent controller can be used for a broad range of applications such as machinery, building automation systems, retrofit of time relay systems and many others.

This manual will describe in detail the functional characteristics of the hardware and the operating method of the Comat BoxX controller. The separately available programming manual contains more details about programming and the function blocks.

Note

- (1) Copyright of this manual is the property of Comat AG. No reproduction or duplication of all or part of the contents of this manual is permitted without prior consent.
- (2) Our company reserves the right to make changes in design for improvement without notification.
- (3) In the event that something is missing or there are discrepancies in this manual then please contact us and we will endeavour to incorporate your comments in the next revision.

This issue replaces all previous issues.

Availability, errors and specifications may be changed without notice.



Safety Guide

This manual contains the precautions necessary to ensure your personal safety and the protection of the product and the connected equipment. These precautions are highlighted with a triangle symbol in this manual and are marked according to the danger levels as follows:



Caution:

This indicates that if appropriate precautions are not taken then injuries or losses of properties will take place.



Warning:

Indicates hazards that may occur in case of improper use. Hazards that may damage the device or its environment. Only qualified staff is authorized to operate this equipment.



Note:

Points out important information about the device or its handling.



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1 Brief Introduction to Comat BoxX

1.1 Overview

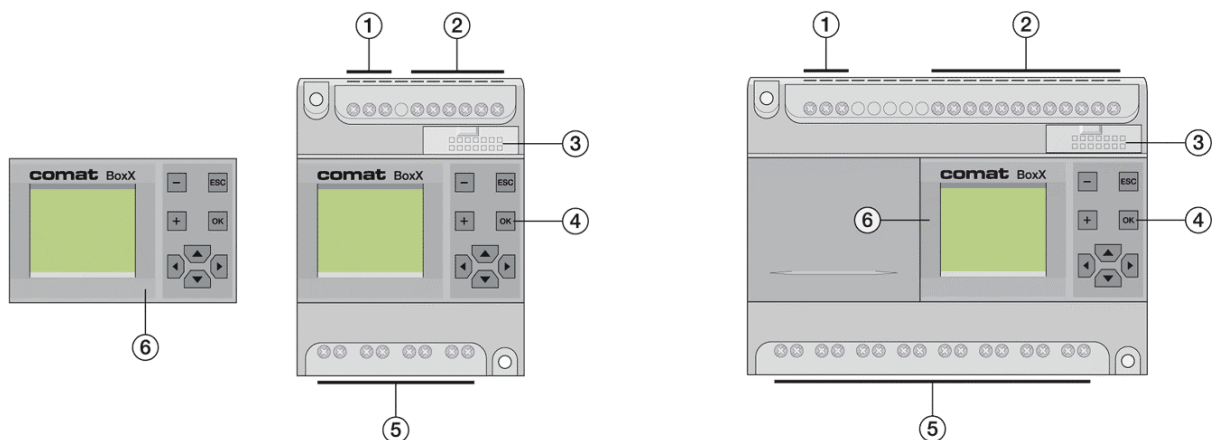
The Comat BoxX intelligent controller is closing the gap between simple one-function controls such as time relays and more sophisticated PLC controls on the market of industrial electronics. Programming is learned easily due to a good overview and functions that are kept to the basics. Furthermore it will be the pleasure of Comat AG and it's resellers to assist for any kind of question.

The Comat BoxX is available as either 24 Volt DC, or 230 Volt AC device. A big variant providing 12 inputs and 8 outputs can be chosen as well as a small variant with 6 inputs and 4 outputs. Both are available with and without Display and the DC-type might be chosen with transistor output instead of relay. This simple assortment together with the easy programming makes the BoxX a device for instant and easy solutions.

The device may be used with a voice module (AF-MUL) which allows sending voice alarms through an analogue telephone line and receive commands by a telephone keypad. The voice module can call predefined telephone numbers and play the previously recorded messages.

These functions allow the BoxX to cover a broad variety of applications in industry, agriculture, automation, building control and lots more.

Overview of parts and connections:



1. Power inlet.
2. Input terminal.
3. Connector for programming cable AF-DUSB, AF-D232.
4. Operating keys.
5. Output terminal (relays or transistor).
6. LCD Display.



1.2 Part Numbers and Accessory

The following Comat BoxX parts and accessory are available:

Typ	Power	Input	Output
AF-10MR-A	110-230 VAC	6 AC	4 relays
AF-10MR-D	24 VDC	6 DC or analogue	4 relays
AF-10MT-GD	24 VDC	6 DC or analogue	4 transistors PNP
AF-20MR-A	110-230 VAC	12 AC	8 relays
AF-20MR-D	24 VDC	12 DC or analogue	8 relays
AF-20MT-GD	24 VDC	12 DC or analogue	8 transistors PNP
AF-MUL/AC	110-230 VAC	Voice and remote control unit	
AF-MUL/DC	12-24 VDC	Voice and remote control unit	
AF-LCD	LCD Display with keys		
AF-CAP	Front-cover (if no display is used)		
AF-D232	Programming cable serial interface (RS232), Connection to BoxX		
AF-RS232	Programming cable serial interface (RS232), Connection to AF-MUL		
AF-DUSB	Programming cable USB-Interface (Driver required)		
AF-BC	Bridge connector between Comat BoxX and AF-MUL		
AF-AUD	Audio cable AF-MUL to PC-audio-Jack		
AF-ATL	Adapter AF-AUD to WAV-clamp of AF-MUL		
Quick II	Programming environment (free download on www.comat.ch)		



1.3 Features of Comat BoxX

1. **LCD Display:** For all controls of the BoxX a display including operating keys is available. It is mounted on the front side of the BoxX and is showing the status of inputs and outputs and the time. Through it, different system parameter can be set. If no display is used, the connector is covered with AF-CAP.
2. **Compact design:** The small dimensions save valuable space in your system. The outer dimensions are: 90 x 71 x 58 mm for AF-10 and 90 x 126 x 58 mm for AF-20.
3. **Programming:** Function blocks available in the programming environment QuickII are placed on the sheet and connected by „Link“. After download, the program remains stored in the device even without power supply. Creating and erasing of function blocks is also possible through the keys of the display.
4. **Quick II free programming environment:** The programming tool Quick II is kept to the basics and therefore very user-friendly. Not only creating and downloading programs is possible, but also simulation and real-time debugging. The program is downloaded and installed to the Comat BoxX or is saved on the computer as *.BOX file.
5. **Real-Time-Clock:** The real-time-clock (RTC) included in the BoxX allows the programming of time based actions such as time of day, day of week or date.
6. **Analogue Input:** Next to digital inputs, the Comat BoxX can read analogue signals. This allows monitoring of temperatures, humidity, pressure, flow etc. through relative sensors. Analogue input values can be compared to each other or to a threshold.
7. **Remote programming and monitoring:** It is possible to control the BoxX through a common modem connection. Profound modem knowledge is therefore recommended.
8. **Security Password:** To protect the program, a password must be entered before download or upload of a program (the factory setting is 0001). The password can be changed through the display and keys.
9. **Telephone function:** The voice module (AF-MUL) enables the BoxX to call telephone numbers and play alarm messages. The Comat BoxX can also receive calls and be controlled by the keypad of the calling telephone. It is connected by the bridge connector AF-BC to the BoxX.

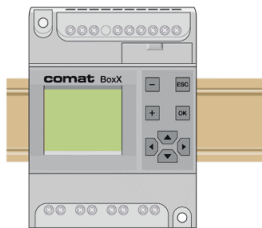


2 Installation and Wiring

2.1 Mounting

The device can be mounted in two different ways:

1. Assembly on standard DIN rail.
2. Assembly through screw holes Ø 4 mm to a flat surface.



Assembly on DIN rail

The Display is removed by a screw driver, and mounted by clicking into place.



Removing the display



Caution:

Before mounting or removing of the displays, the device must be unplugged from power supply.
See also chapter 2.2 Dimension.

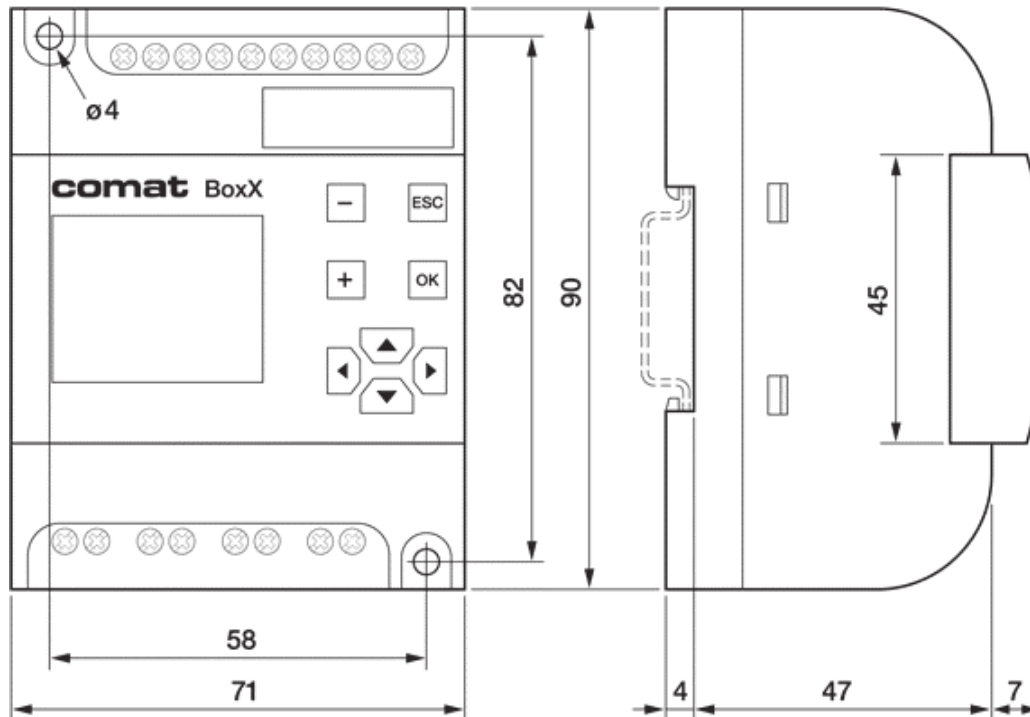


Warning:

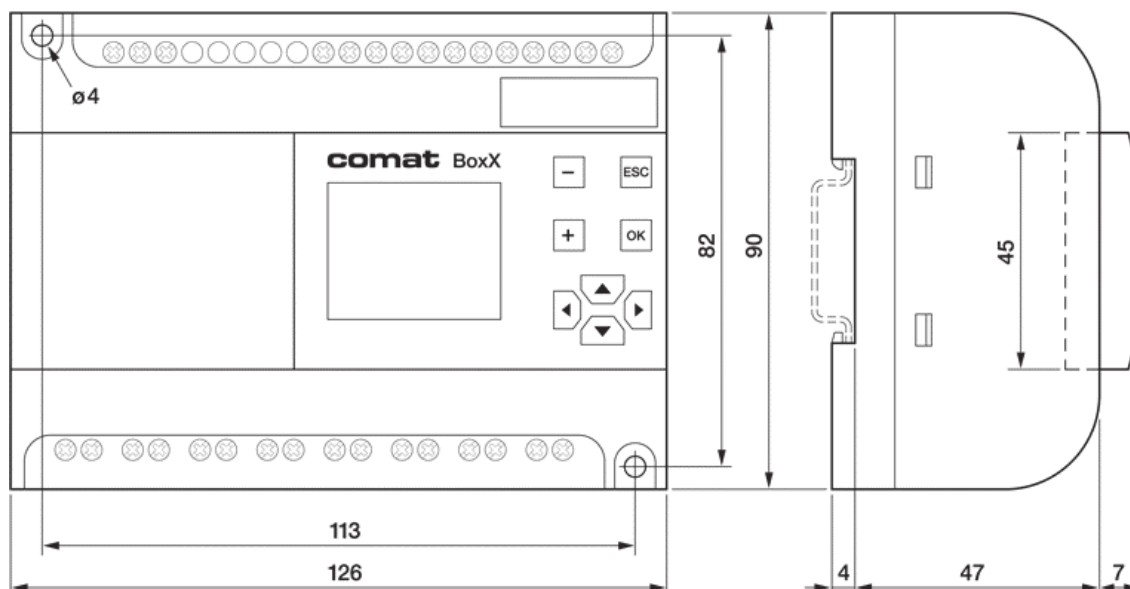
Only trained staff is authorized to mount, install or operate the device.



2.2 Dimensions



Dimensions of AF-10 in mm



Dimensions of AF-20 in mm



2.3 Wiring

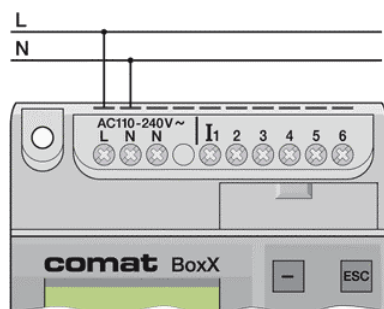
2.3.1 Powersupply

The Comat BoxX is wired according to the pictures below. Nominal voltages are:

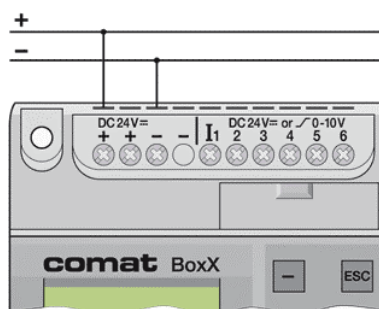
AF-10MR-A 110 - 230VAC
AF-20MR-A 110 - 230VAC

AF-10MR-D 12 - 24VDC
AF-10MT-GD 12 - 24VDC
AF-20MR-D 12 - 24VDC
AF-20MT-GD 12 - 24VDC

Wiring:



Power supply AC



Power supply DC



Note:

For detailed specification see also chapter 3.2.2 Power Supply.

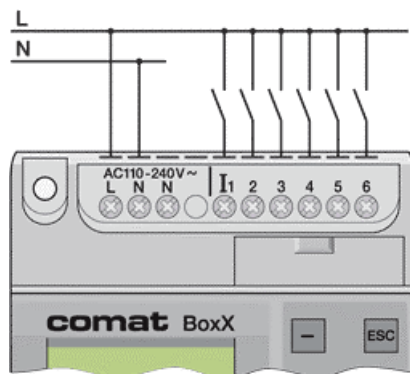


2.3.2 Inputs

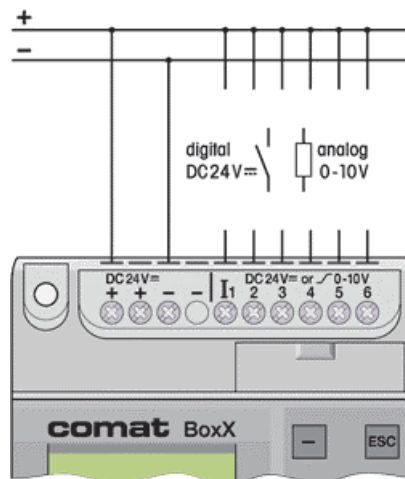
The Comat BoxX can read in digital and/or analogue signals (depending on type). The configuration as analogue- or digital-input is made in the program. The wiring is according to the pictures and the following points must be considered:

1. Only the types AF-10MR-D, AF-10MT-GD, AF-20MR-D and AF-20MT-GD can read in analogue signals. All inputs I1 - I6 / I1 - I12 can individually be used as digital or analogue.
2. Analogue signals are read using AN-function blocks in the program. Without using these function blocks, the input will be read as digital value. Analogue input values can be compared to each other or to a threshold.
3. Analogue signals can cover the range of 0 to +10V and have a resolution of 0.1V.
4. Signals above +10V are read in as digital signals.
5. The minimum length of a signal on a digital input must be 50 ms. Shorter signals may not be recognized.

Wiring of the inputs:



AC Types
Voltage on inputs: 230 VAC



DC Types with analogue inputs
Voltage on inputs: 24 VDC (0..10 VDC)



Note:

Detailed specification see chapter 3.3 Inputs.

Digital signals are signals from switches, relays, thermostat, etc. (Values: 0 or 1).

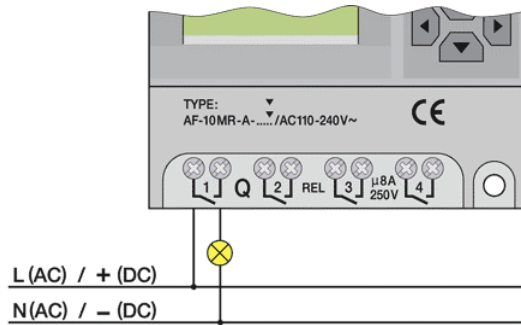
Analogue signals are signals from sensors as pressure, temperature, etc. (Values: 0.0 V to 10.0 V).



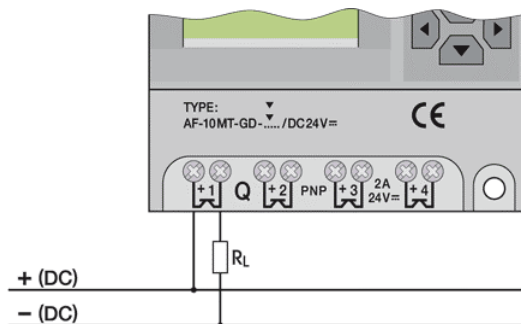
2.3.3 Outputs

The types AF-10MR-A, AF-20MR-A, AF-10MR-D and AF-20MR-D include relay outputs, the types AF-10MT-GD and AF-20MT-GD include PNP transistor outputs. Different loads (lamps, motors, contactors, etc.) can be directly connected as shown below:

Relay outputs:



Transistor outputs:



Warning:

The transistor outputs must be supplied by the same source as the device.



Note:

Detailed specification see chapter 3.4. Output.



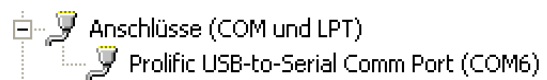
2.4 Commissioning and Program Download

Before or after the installation the device is programmed. This chapter shows how to establish the connection between the BoxX and the computer for programming. More about programming and the function blocks can be found in the separately available programming manual.

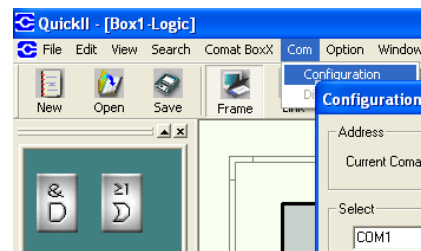
The connection is established through USB or serial interface (RS232). For connection through USB, the cable AF_DUSB is used. This cable requires the installation of a driver on the computer. For the connection through the serial interface the cable AF-D232 (connected to BoxX) is used. If the voice module (AF-MUL) is used, the download can be performed through the cable AF-RS232 (connection to AF-MUL). The following must be considered:

The driver for AF-DUSB (free download) will provide a new COM-port on the PC.

The COM-port is named „Profilic USB-to-Serial Comm Port“ and can be identified in Windows operating systems under Start > Control Panel > System > Hardware > Device Manager (Win XP)



The COM-port must be set in QuickII to establish the connection before download. See menu Com > Configuration.



AF-D232



AF-DUSB



AF-RS232



Note:

The factory setting for the password is 0001.

The factory setting for the Address is 000.



3 Technical Data

3.1 General Data

3.1.1 Ambient Condition

Description	Standard	Data
Ambient operating temperature		0 - 55 °C
Ambient transport/storage temperature		-40 - 70 ° C
Relative humidity	IEC 68-2-30	5 - 95 % No condensation

3.1.2 Clock

Description	All Types
Accuracy	+/- 5 seconds per day
Back-up time	100 h



3.1.3 Mechanical Data

Description	Standards	Data
Protection	IEC 60529	IP 20
Dimension		Over all dimensions W/D/H Type: AF-10; AF-MUL: 71/58/90 mm Type: AF-20: 126/58/90 mm See drawings in chapter 2.2 Dimensions
Case material		ABS (Acrylnitril Butadien Styren)
Terminals		Screw terminals with wire protection: 2,8 mm x 4.4 mm for max. 1 x 4 mm ² flex With end spice M3, slotted head screw, Screw driver no. 1, 0.5 Nm
Terminal AF-MUL		D-Sub 9-pol. for programming (RS232) RJ 12 for telephone line
Fixation	EN60715	Top hat rail DIN TS 35 or screw fixing 2 x M3 (hole diameter 4,0 mm)
Weight		AF-MUL: 210 g; AF-10MR: 245 g; AF-10MT: 210 g; AF-20MR: 380 g AF-20MT: 320 g Total weight including display module



3.2 Electrical Data

3.2.1 Elektro Magnetic Immunity

Description	Standard	Data
Static discharge (ESD)	EN 61000-4-2	8 kV air 6 kV contact
Electromagnetic Emission	EN 55022 / 99	
Electromagnetic Imission	EN 61000-4-8 EN 61000-4-3	Standard fulfilled. Inductive field strength 3A/m
Emission on wiring	EN 55011	Standard fulfilled
Surge	EN 61000-4-5	AC 110-240 V Level 3 = 2 kV DC 24 V Level 1 = 500 V
Burst	EN 61000-4-4	AC 110-240 V Level 3 = 2 kV DC 24 V Level 1 = 500 V

3.2.2 Power Supply

Description	Data / Types:	AF-10MT-GD AF-20MT-GD AF-10MR-D AF-20MR-D AF-MUL/DC
Nominal voltage	AC 110 - 240 V	DC 24 V
Operating voltage range	AC 85 - 250 V	DC 10.5 - 30 V AF-MUL: DC 18 - 30 V
Frequency range	50/60 Hz 47 - 63 Hz	
Power consumption	AF-10: 3 W AF-20: 5 W AF-MUL: 1,5 W	..MT-GD: 2 W ..MR-D: 5 W



3.3 Inputs

3.3.1 Digital Inputs

Description		Data / Types:	
		.../AC110-240V	.../ DC24V
Input voltage	0-Signal (inactive)	0 - 40 VAC	0 - 5 VDC
	1-Signal (active)	80 - 250 VAC	15 - 30 VDC
Input current	1-Signal	0.25 mA (@ 230 VAC) 3 mA (@ 24 VDC)	
Delay time	high to low	50 ms, typical	
	low to high	50 ms, typical	

3.3.2 Analogue Inputs

Description	Data
Input resistance	50.2 kΩ
Input voltage range	0 - 10 V
Resolution	0,1 V
Analogue input thresholds for digital read in	
Input voltage 0-Signal (inactive)	0 - 8 VDC
1-Signal (active)	12 - 60 VDC



3.4 Outputs

3.4.1 Relay Outputs

Description	Data
Output type	Relay μ , 4 x NO / 8 x NO (Normally Open)
Contact material	AgSnO
Switching current	100 mA - 8 A AC1; 8 A, 30 V DC1
Switching voltage	6 - 250 V
Switching power	2000 VA; 250 W
Total current / device	24 A
Contact resistance	100 m Ω / 1 A, 6 VDC
Inrush current	30 A / 10 ms
Isolation contact / device	4 kVrms, 1min
Isolation contact / contact	3 kVrms, 1min
Isolation open contact	1 kVrms, 1min
Switching frequency	2 Hz
Life cycles mechanical	10 x 10 ⁶ Cycles
electrical	2 x 10 ⁵ / 8 A, 250 V AC1

3.4.2 Transistor Outputs

Description	Data
Output type	PNP Transistor (FET)
Switching current	2 A DC1 / $v_u \leq 40^\circ \text{C}$
Inrush current	10 A / 10 ms
Total current / device	AF-10: 4 A; AF-20: 8 A
Switching voltage	5 - 60 VDC
Forward resistance / voltage drop	0,3 Ω
Leakage current	< 100 μA
Switching frequency	10 Hz / DC1 load
Insulation	Not galvanically separated
Surge voltage limitation	Integrated / $-U_{\text{peak}} < 80 \text{ V}$



3.5 Voice Module AF-MUL

Description	Data
Outgoing call method	Dual-tone multi-frequency (DTMF)
Remote control method	Dual-tone multi-frequency (DTMF) (keypad of the telephone)
Recording and play	Max. 98 recordings with a total duration of 8 min
Audio output external loudspeaker	Terminals 1-2; $R_i = 1200 \Omega$, 1 mW
Audio input (WAV)	Terminals 3-4; 10 k Ω analogue audio in
Power consumption	0.7 W

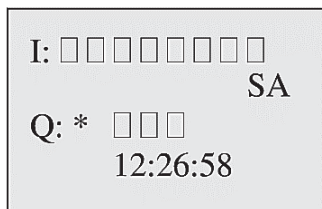


4 LCD-Display and Keys

4.1 Status Indication

While the Comat BoxX is under operation, the following status are indicated:

- I For inputs I1-I6 (for AF-10...) or I1-I12 (for AF-20...).
- Q For outputs Q1-Q4 (for AF-10...) or Q1-Q8 (for AF-20...).
- * For input signal ON or output signal active.
- For input signal OFF or output signal inactive.
- Clock running The Comat BoxX is in Run-mode (Program is being executed)
- Clock stops The Comat BoxX is in Stop-mode (Program is not being executed)

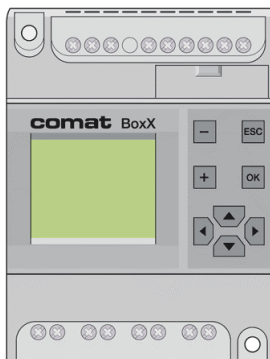


Status Indication

4.2 Operation

During operation, the keys are inactive. They are only used to operate the system menu. How to enter into the system menu see chapter 4.3. The keys are operated as follows:

1. The input cursor ' _ ' is indicating that parameters can be entered. The cursor can be moved by using the following keys: ; ; ; .
2. The keys and are used to set the parameter when the input cursor is blinking ' _ '.
3. The key is used to confirm the entered value. The key is used to cancel it.
4. The menu cursor ' > ' can be moved by using and . By using the selection of a menu item is confirmed. is used to go back one level in the menu structure. Some menus can be quit by using the key .



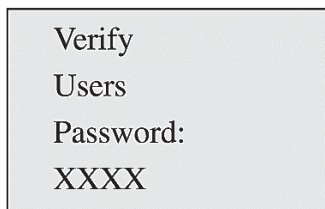
Keys for operation



4.3 System Menu

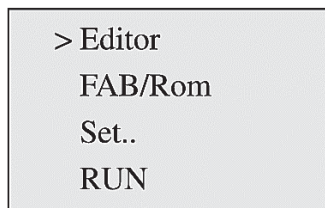
The system menu allows the operator to change settings without connecting a computer. It is possible to set time and date, the operating mode (run, stop), the password, and the address. It is also possible to create and delete function blocks.

The system menu is entered by pressing **ESC** and **OK** at the same time. The display as below is then shown and the password must be entered by using the keys **+**, **-**, **▶** and **OK**. The factory setting for the password is 0001. If three times a wrong password is entered, the main display according to chapter 4.1 is shown again.



Entering the password to enter the system menu

The following picture shows the main menu. It is navigated as described in chapter 4.2.



System menu

Menu item	Functions
Editor	Create new program (New Prg) Add function blocks (Insert FB) Delete function blocks (Delete FB) Delete program (Clear Prg)
FAB/Rom	Read program (Rom -> FAB) (Edit program) Change address (FAB_Addr) Reset Modem (Modem)
Set..	Set date, time and password
RUN	Start program / Return to normal operation mode



Warning:

If the program is changed incorrectly, the security of the device and its environment might no longer be granted. It is highly recommended to change programs only by using the programming environment QuickII.